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Community Acceptance of Tempeh-based Artificial Meat for Food Accessibility Solutions

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Abstract. Climate change is becoming a global issue that increasingly affects various sectors worldwide, including infrastructure development in Indonesia. The livestock sector contributes to significant greenhouse gas emissions and impacts global warming from large amounts of animal waste. The increasing demand for red meat has made the price of meat expensive, causing inequality in food consumption. The consumption disparity certainly requires a new solution to this euphoria, considering that the amount of emissions produced by ruminant cattle farming is much higher than that of soybean or rice crops. Plant-based mock meat is a suitable alternative to animal meat because it can reduce the demand for red meat in the market, reducing livestock gas emissions that can trigger climate change. Local plant-based mock meat can realize sustainable accessibility due to its availability and ease of obtaining it. This study aims to determine the formula level and public acceptance of mock meat made from tempeh flour to realize food accessibility in reducing red meat consumption. The method used in this research was experimental, and a comparative trial of public acceptability of the four products was conducted with the control codes F10%, F20%, and F30%. Data analysis and processing techniques were carried out using the One Way Anova Ranks, Kruskal Wallis method, and Dunn's further test. The results showed that the acceptance of panelists, as many as 42 people, gave the highest average favorability score, and the overall selection was the experiment code F30% with a mean value of 4.6, which is close to the assessment of very like compared to other development products.

Keywords: Meat analog, climate change, local tempeh, substitution.

INTRODUCTION

Climate change has become a global issue that increasingly affects various sectors worldwide, including infrastructure development in Indonesia (Kurniasih et al., 2023). In recent years, the impacts of climate change have become a severe concern for the government and experts. Climate change impacts water conditions, habitats, forests, health, agriculture, and coastal areas (Haryanto & Prahara, 2019). Natural disasters such as droughts, floods, and landslides are some events resulting from climate change. According to the Ministry of Environment and Forestry Republic of Indonesia (2020), climate change is influenced by greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These gases originate from deforestation, forest fires, wetland conversion, peat and mangroves, rice farming, livestock, and environmentally unfriendly fertilizers (Wahyuni & Suranto, 2021). The livestock sector contributes significantly to greenhouse gas emissions and impacts global warming from large animal waste (Yusuf, Purnomo, et al., 2024). One of the greenhouse gas emissions cattle produce is methane (CH_4). The Central Statistics Agency (BPS) recorded that methane emissions from beef cattle in Indonesia reached 45.5 kg/head/year (Grehenson, 2021) in Lumakso & Marwa (2023). In addition to producing milk and meat, dairy farming also generates waste in the form of feces and urine. The high levels of waste produced can lead to pollution. Although the application of methane gas from cow dung has been converted into biogas, the fermentation process still takes a considerable amount of time.

The demand for beef among the public continues to rise. Indonesia's beef consumption in 2021 was around 717,750 tons per year. However, domestic beef production was only 437,783 tons per year. Indonesia imports frozen meat to meet the demand, amounting to 279,970 tons per year (Waluyo, 2023). According to Lumawir et al. (2023), the imbalance between supply and demand is the reason for the high beef prices in Indonesia. Beef consumption for the lower-middle class occurs only during certain times, such as Eid al-Fitr or Eid al-Adha. This has led to an imbalance in food consumption, whereas welfare should belong to all Indonesians. Malnutrition, hunger, and difficult access to food cause various health issues such as malnutrition, stunting, marasmus, kwashiorkor, anemia, and even other serious diseases. Zero hunger in the sustainable development goals is crucial for eradicating hunger, achieving food security, improving nutrition, and supporting sustainable agriculture. This goal aims for everyone to access sufficient, safe, nutritious food.

The high demand for food worldwide for red meat needs human life has led many people to raise livestock to meet market demand (cattle, goats, buffalo, pigs) (Suhubdy, 2021). According to the Food and Agriculture Organization, global meat consumption is projected to double to 465 million tons by 2050, significantly increasing the number of meat-producing animals in nature and destabilizing ecosystems. Livestock waste contributes 14.5% of emissions to global warming (Maulina, 2021). According to (Muliana et al., 2021), the gases resulting from livestock waste management and enteric fermentation are methane, carbon dioxide, nitrous oxide, and ammonia. This is closely related to the role of the global community and Indonesian society in helping to reduce the consumption of red meat in daily dishes frequently and reduce the frequency of red meat consumption, in line with Sustainable Development Goal point 13, which is "Climate Action," aimed at taking action to combat climate change and its impacts affecting everyone.

The high price of red meat in the market causes people with lower-middle economic levels to consume meat rarely. The inequality in consumption certainly requires new solutions to face this euphoria, considering that the emissions produced by ruminant livestock are many times higher than those from soybean or rice cultivation (Akhadiarto & Rofiq, 2017). The processing of non-genetically modified local soybeans becomes very promising as a substitute for beef because it has nearly equivalent protein content. Tempeh also contains vitamin B12 produced by bacteria that are not found in other plant-based food products, where this vitamin is only present in red meat (Pinasti et al., 2020). The affordable price of tempeh and the abundant supply of locally sourced Indonesian soybeans make this processed product also potential for addressing environmental sustainability and resilience, especially when meat products begin to become contaminated, thus contributing to achieving SDGs Point 2, namely "Ending Hunger, Achieving Food Security and Improved Nutrition, and Promoting Sustainable Agriculture" using local ingredients.

Meat analogs are imitation meats as an alternative to red meat to reduce greenhouse gas emissions from livestock farming (Sun et al., 2021). According to Zhang et al. (2021), meat analogs are made from highly protein-containing ingredients, such as soybeans, gluten, and additives for flavor, color, and texture. Meat analog has an aroma, shape, and texture that closely resembles red meat because it is made through the deepening of science and technology (Riyanto et al., 2022). According to Mentari & Baskara Katri Anandito (2016) in Astawan (2009), like meat in general, meat analog has fibers in its composition that make this product genuinely resemble authentic red meat. The selling price of meat analog products is more affordable for the community compared to red meat, so when meat analog is marketed (Joshi & Kumar, 2015), the equitable consumption and improvement of community nutrition will be easier to address by reaching every food issue across all corners of Indonesian society.

Based on the above problems, this study aims to determine the level of formula and public acceptance of artificial meat made from tempeh flour as a solution to realize food accessibility in reducing red meat consumption. The innovation of tempeh-based artificial meat contributes to environmental sustainability by producing fewer emissions than red meat-producing farms. In addition, tempeh-based artificial meat can overcome food security problems by using local food ingredients and equalizing consumption in the community at a more economical price.

METHOD

Procedure of Research

This research was conducted at the Chemistry Laboratory of Tata Boga Education, Yogyakarta State University, with the duration of the research process for 2 months. The method used in this research is the experimental method.

The experimental method is research conducted by conducting trial activities to see a result (Syam et al., 2022). According to Alijrih et al. (2024), experiments begin with design and testing. This research aims to develop and produce a new product through predetermined steps. Researchers conducted experiments on making analog meat with the addition of tempeh flour substitution of 10%, 20%, and 30% for the exact three replicates in the control or reference group according to the formulation in Table 1. According to Kyriakopoulou et al. (2019), the percentage selection makes it easier for researchers to assess the balance of the final result of the meat analog, which is pretty close so as not to damage the organoleptic characteristics of the developed meat analog.

TABLE 1. Formulation of meat analog recipe with tempeh flour substitution.

Material	Reference	Development		
	R	F1 (10%)	F2 (20%)	F3 (30%)
Vital Wheat Gluten	175g	157,5	140	122,5
Local Soybean Tempeh Flour	0	17,5	35	52,5
Soybeans	75g	75g	75g	75g
Puree tomato	30g	30g	30g	30g
Nutritional Yeast	25g	25g	25g	25g
Chili powder	15g	15g	15g	15g
Garlic powder	15g	15g	15g	15g
Pepper	7g	7g	7g	7g
Salty soy sauce	15ml	15ml	15ml	15ml
Salt	7g	7g	7g	7g
Water	90ml	90ml	90ml	90ml

Object of Research

The selection of panelists in this research test was conducted by considering demographic balance for more accurate consumer representation (Ruiz-Capillas & Herrero Herranz, 2021). The test was conducted on untrained panelists or the general public, with 42 panelists. Panelists were selected based on several specific criteria to provide a relevant picture of the product that will be accepted in the market (Drake et al., 2023). Panelists ranged in age from 18-45, with a gender distribution of 64% female and 36% male. Panelists were of diverse income levels, with a distribution of 42.9% low income, 33.3% middle income, and 23.8% high income.

Materials and Tools

The current experimental materials are easy to find, especially in nearby supermarkets or grocery stores (Purwanti & Nurwati, 2021). These materials include tempeh flour, gluten flour, red beans, tomato puree, nutritional yeast, soy sauce, garlic powder, water, pepper, salt, and chili powder. The experimental tools used are explained in Table 2.

TABLE 2. Tools for making meat analogs and their functions.

Tool Type	Tool Name	Function
Processing Tools	Pan	For boiling analog meat
Processing Aids	Blender	To mix the dough
	Cutting Board	To cover the dough
	Rolling pin	To flatten the dough
	Knife	To cut dough

Method of Preparation

The research experiment began by boiling red beans and then mixing the bean paste, pepper, salt, soy sauce, garlic powder, tomato puree, and water, then stirring. Next, add local soy tempeh flour and vital wheat gluten. Knead until smooth and form fibers. Flatten the dough using a rolling pin to the thickness of typical meat. Boil for about 7-10 minutes until the dough starts to harden.

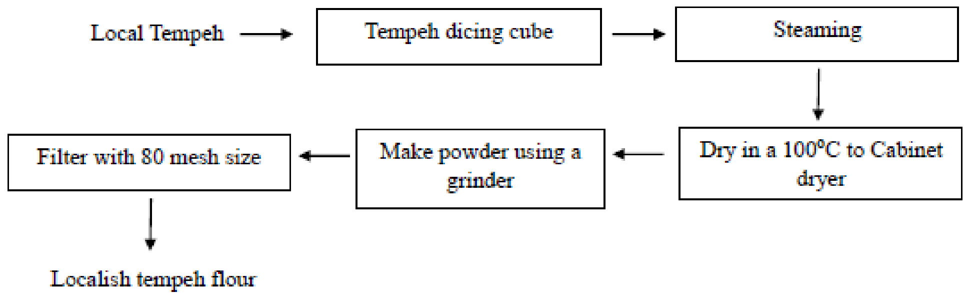

FIGURE 1. Flowchart of tempeh flour production.

Data Analysis and Processing

The trial used in this research to analyze the experimental and control products is a preference test for the public. The preference test uses organoleptic testing with parameter provisions on a scale of 1-5, with categories 1: very dislike, 2: dislike, 3: neutral, 4: like, and 5: very like. Data processing results are conducted with a paired sample t-test to determine the differences between the control and experimental products being compared.

RESULT AND DISCUSSION

Tempeh-based artificial meat's acceptability is unique compared to other plant-based mock meats such as soybean or pea protein (Ismail et al., 2020). Tempeh, fermented from soybeans, offers a natural umami flavor and dense texture, often preferred by consumers who desire a more meat-like eating experience (Romulo & Surya, 2021). However, the acceptance of tempeh in the global market is still constrained by a lack of familiarity compared to other more flavor-neutral alternatives, especially for consumers in Western countries (Ismail et al., 2020). In terms of food security, tempeh offers nutritional advantages including vitamin B12 content rarely found in plant-based products and the ability to be produced from a variety of grains (Poole et al., 2019). In terms of sustainability, the consumption of tempeh mock meat has a lower environmental impact than animal meat or pea-based alternatives that require energy-intensive processes (Kyriakopoulou et al., 2019).

Based on the consumption patterns of the public, particularly the generation born between 1994 and 2016, which currently accounts for 27.94% of the total population in Indonesia (Arum et al., 2023). The researchers have surveyed the urgency of creating a meat alternative derived from plant-based food substituted with Tempeh flour. The results showed that 75 respondents filled out the survey and strongly agreed (the mean total of females and males being 4.67) on creating a meat alternative. The following are the results from the respondents, as shown in Table 3.

TABLE 3. Respondent surveyed on the creation of alternative meat products.

Respondent	Very Dislike (1)	Dislike (2)	Neutral (3)	Like (4)	Very like (5)	Mean	SD
Female	-	-	4	6	28	4.63	0.67
Male	-	-		4	33	4.71	0.63
Number of Respondents				75			

Organoleptic Test

The hedonic organoleptic test is an important preference test conducted when developing a new product because it determines the community's acceptance of it. Thus, it is commonly used as a parameter test to determine the success of a product (Suryono et al., 2018). The results of this organoleptic test consist of acceptance tests for the scores of the formulation products substituting local tempeh flour at 10%, 20%, and 30%, and the control product of imitation meat with 42 untrained panelists. The assessment parameters include color, aroma, taste, texture, packaging, and overall. The data processing used to determine the acceptance of community preference is one-way ANOVA; one uses the Kruskal-Wallis Test to determine the difference in average acceptance of preference towards the product variables studied.

TABLE 4. Descriptives Test.

Organoleptic Test	N	Mean	SD	SE	Coefficient of variation
Control	42	3.400	0.548	0.245	**0.161**
F10%	42	3.400	0.548	0.245	**0.161**
F20%	42	3.900	0.742	0.332	**0.190**
F30%	42	4.600	0.447	0.200	**0.104**

The data analysis of acceptance shows a Shapiro-Wilk result for all variables of 0.003 where (p<0.05) indicates that the data is not normally distributed, while the homogeneity test (Levene's) shows p=0.789 or the data is homogeneous (p>0.05). Based on this description, the average development with the highest mean acceptance is the product with the code F30%, which is 4.600, while F20% has the second highest mean of 3.900, and F10 and Control have the lowest mean products compared to the others with a total mean of 3.400.

TABLE 5. Dunn's Post Hoc Comparisons – Organoleptic Test.

Comparison	z	W_i	W_j	p	p_{bonf}	p_{holm}
Control-F10%	0.000	7.600	7.600	1.000	1.000	**1.000**
Control-F20%	-1.119	7.600	11.500	0.263	1.000	**1.000**
Control-F30%	-2.210	7.600	15.300	0.027	0.163	**0.163**
F10%-F20%	-1.119	7.600	11.500	0.263	1.000	**1.000**
F10%-F30%	-2.210	7.600	15.300	0.027	0.163	**0.163**
F20%-F30%	-1.091	11.500	15.300	0.275	1.000	**1.000**

Furthermore, the Kruskal test was conducted to determine whether significant differences exist among the four developed product variables, followed by the Dunn post hoc test provides Bonferroni and Bonferroni Holm values. There is a significant difference between the overall acceptability of the control group and the experimental group F30% as the significance level p-value shows p=0.027 where (p<0.05). A significant difference occurs again when the overall acceptability of the experimental group F10% is compared with F30%, with a score showing p=0.027, occurring because, from the beginning, the mean of F10% had the same value as the control group's mean. Furthermore, when the acceptability of F20% and F30%, control, and F10% are compared, there is no significant difference as the significance level is p>0.05.

Color

The average acceptability of the lowest color of the imitation meat is found in the control product color parameter at 3.340, while the color acceptability with the highest average is F30% at 4.480. Subsequently, the Kruskal test shows a significance level of p=0.026 (p-value<0.005), which means there is a significant difference in the organoleptic test group where the panelists preferred the color of the F30% product because the color produced is similar to that of real meat compared to the colors of other organoleptic test products.

Aroma

The results of the organoleptic test on aroma have a p-value score of 0.023 (<0.05), indicating a significant difference in preference for the aroma of the meat analog among the Control, F10%, F20%, and F30% products. F30% has the lowest mean acceptance score of 3.740, while F10% has the highest mean score of 4.560. This occurs because the F30% product has the highest addition of tempeh flour compared to the other products, affecting the resulting aroma.

Texture

The acceptance of the panelists towards the texture of the meat analog shows a highly significant p-value, meaning that most panelists have a very noticeable difference in preference among the Control, F10%, F20%, and F30% products, as the addition of tempeh flour makes it slightly coarser and not as soft as the reference product.

Overall

The results of the organoleptic test of meat analogs overall show that the p-value is less than (<0.05), which means it is highly significant and indicates a difference in the panelists' preferences for the overall reference product and the developed products. The panelists preferred the development product coded F30% over each tested code. Based on the descriptive plot above, F30% has the highest overall acceptance compared to the development products coded F20%, F10%, and the control.

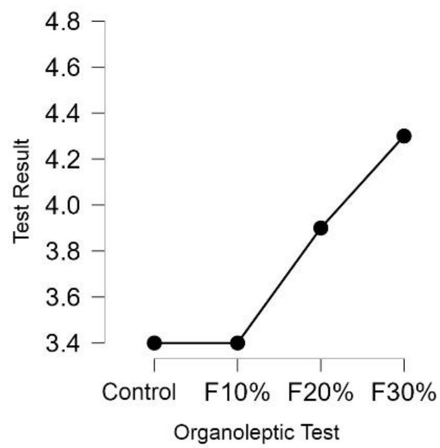

FIGURE 2. Descriptives plot meat analog.

CONCLUSION

The formula for making artificial meat alternatives with the highest overall acceptability is a 30% tempeh flour substitution. The results showed that the 30% local soybean tempeh flour substitution significantly differed in public acceptability, especially color, aroma, taste, and texture, compared to the experimental formulations F10%, F20%, and the control product. The overall organoleptic test of F30% artificial meat products showed the highest mean value of 4.600, indicating that panelists preferred the local soybean tempeh flour development product.

Tempeh-based artificial meat products have great potential to be widely marketed, especially since tempeh is an affordable and nutrient-rich source of plant-based protein. This product can be an alternative solution to the imbalance in animal meat consumption, especially in developing countries. In addition, reducing animal meat consumption and replacing it with tempeh-based mock meat can significantly reduce emissions from livestock farming. For further research related to tempeh-based artificial meat, it is expected to have organoleptic characteristics that are more accepted by all groups so that it can be marketed widely. Besides, local ingredients are needed to help people achieve accessibility and food security.

REFERENCES

1. Akhadiarto, S., & Rofiq, M. (2017). Estimate Of Methane Emissions from Enteric Fermentation by Ruminant Animals Using Tier-1 Methods in Indonesia. *Jurnal Teknologi Lingkungan*, *18*(1), 1–8. https://dx.doi.org/10.29122/jtl.v18i1.38
2. Arum, L. S., Zahrani, A., & Duha, N. A. (2023). Karakteristik Generasi Z dan Kesiapannya Dalam Menghadapi Bonus Demografi 2030. In *Accounting Student Research Journal* 2(1), 59-72. https://doi.org/10.62108/asrj.v2i1.5812
3. Drake, M., Watson, M., & Liu, Y. (2023). Article In Annual Review of Food Science and Technology. *Annual Review of Food Science and Technology*, *14*(1), 427–448. https://doi.org/10.1146/annurev-food-060721
4. Haryanto, H. C., & Prahara, S. A. (2019). Perubahan Iklim, Siapa Yang Bertanggung Jawab? *Insight: Jurnal Ilmiah Psikologi*, *21*(2), 50. Ihttps://doi.org/10.26486/psikologi.v21i2.811

5. Ismail, I., Hwang, Y. H., & Joo, S. T. (2020). Meat Analog as Future Food: A Review. In *Journal of Animal Science and Technology* (Vol. 62, Issue 2, Pp. 111–120). Korean Society of Animal Sciences and Technology. https://doi.org/10.5187/jast.2020.62.2.111
6. Joshi, V., & Kumar, S. (2015). Meat Analogues: Plant Based Alternatives to Meat Products- A Review. *International Journal of Food and Fermentation Technology*, *5*(2), 107. https://doi.org/10.5958/2277-9396.2016.00001.5
7. Kurniasih, P., Prodi, D., Politeknik, T., Pelayaran, I., Jalan, S., 2a, S., Semarang, K., Dewi, K., Penerbitan, P. B., & Politeknik, P. (2023). Pengaruh Perubahan Iklim Pada Sektor Ekonomi Dan Transportasi. *Berkala Fstpt*, *1*(3), 1–9. https://doi.org/10.19184/berkalafstpt.v1i3.602
8. Kyriakopoulou, K., Dekkers, B., & Van Der Goot, A. J. (2019). Chapter 6 - Plant-Based Meat Analogues. In C. M. Galanakis (Ed.), *Sustainable Meat Production and Processing* (Pp. 103–126). Academic Press. Https://Doi.Org/10.1016/B978-0-12-814874-7.00006-7
9. Lumakso, & Marwa. (2023). *Merespons Tudingan Penyebab Pemanasan Global: Bagaimana Peternak Harus Menyikapi?* Megashift Fisipol Ugm. https://megashift.fisipol.ugm.ac.id/2023/12/11/merespons-tudingan-penyebab-pemanasan-global-bagaimana-peternak-harus-menyikapi/
10. Lumawir, G. D. D., Umboh, S. J. K. J. K., & Kalangi, L. S. (2023). Analisis Permintaan Impor Daging Sapi Di Indonesia. In *Jambura Journal of Animal Science 49 Apa Citation* (Vol. 5, Issue 2). https://ejurnal.ung.ac.id/index.php/jjas/arcive
11. Maulina, S. (2021). *Minimalisir Efek Rumah Kaca Akibat Peternakan, Dimanakah Peran Dokter Hewan?* Universitas Airlangga. https://unair.ac.id/minimalisir-efek-rumah-kaca-akibat-peternakan-dimanakah-peran-dokter-hewan/
12. Mentari, R., & Baskara Katri Anandito, R. (2016). Jurusan Ilmu Dan Teknologi Pangan Universitas Sebelas Maret Avaliable Online At Jurnal.Uns.Ac.Id/Teknosains-Pangan. *Jurnal Teknosains Pangan*, *5*(3).
13. Ministry Of Environment and Forestry Republic of Indonesia. (2020). *Gas Rumah Kaca*. Kementerian Lingkungan Hidup Dan Kehutanan Republik Indonesia. https://adaptasi.ppi.menlhk.go.id/adaptasi/getDetailContent/1/4
14. Muliana., Azhari, M., & Imam, A. (2021). Evaluasi Gas Rumah Kaca (Ch 4) Dari Sektor Peternakan. *Jurnal Teknik Silitek*, *01*(01).
15. Pinasti, L., Nugraheni, Z., & Wiboworini, B. (2020). Potensi Tempe Sebagai Pangan Fungsional Dalam Meningkatkan Kadar Hemoglobin Remaja Penderita Anemia. *Action: Aceh Nutrition Journal*, *5*(1), 19. https://doi.org/10.30867/action.v5i1.192
16. Poole, T. L., Benjamin, R., Genovese, K. J., & Nisbet, D. J. (2019). Methylsulfonylmethane Exhibits Bacteriostatic Inhibition of Escherichia Coli, And Salmonella Enterica Kinshasa, In Vitro. *Journal Of Applied Microbiology*, *127*(6), 1677–1685. https://doi.org/10.1111/jam.14446
17. Purwanti, H., & Nurwati, N. (2021). Implementasi Pjbl Pada Pembelajaran Boga Dasar Secara Daring Di Masa Pandemi Covid-19. *Jurnal Keluarga*, *07*(02). http://jurnal.ustjogja.ac.id/index.php/keluarga/index
18. Riyanto, B., Syafitri, U. D., Santoso, J., & Yasmin, E. F. (2022). Characteristics Of Meat Analog with Formula Optimization Of Seaweed Substitution Using Mixture Design. *Jurnal Pengolahan Hasil Perikanan Indonesia*, *25*(2), 268–280. https://doi.org/10.17844/jphpi.v25i2.39942
19. Romulo, A., & Surya, R. (2021). Tempe: A Traditional Fermented Food of Indonesia And Its Health Benefits. In *International Journal of Gastronomy and Food Science* (Vol. 26). Azti-Tecnalia. https://doi.org/10.1016/j.ijgfs.2021.100413
20. Ruiz-Capillas, C., & Herrero Herranz, A. (2021). Sensory Analysis And Consumer Research In New Product Development. *Foods*, *10*(3), 582. https://doi.org/10.3390%2Ffoods10030582
21. Suhubdy, S. (2021). Potensi Dan Prospek Ternak Herbivora Lokal Nonsapi Sebagai Kimah Nasional Dalam Menunjang Ketahanan Pangan Hewani di Indonesia. *Prosiding Seminar Nasional Teknologi Agribisnis Peternakan (Stap)*, 9–31. https://jnp.fapet.unsoed.ac.id/index.php/psv/article/view/999
22. Sun, C., Ge, J., He, J., Gan, R., & Fang, Y. (2021). Processing, Quality, Safety, And Acceptance of Meat Analogue Products. In *Engineering*, 7(5), 674–678. https://doi.org/10.1016/j.eng.2020.10.011
23. Suryono, C., Ningrum, L., & Dewi, T. R. (2018). Uji Kesukaan Dan Organoleptik Terhadap 5 Kemasan Dan Produk Kepulauan Seribu Secara Deskriptif. *Jurnal Pariwisata*, *5*(2). http://ejournal.bsi.ac.id/ejurnal/index.php/jp

24. Syam, S. O., Fadiati, A., & Mahdiyah. (2022). The Effect Substitution of Taro Beneng Flour (Xantoshoma et al.) on The Quality Of Crekers Based On Tapioca Starch. *Journal Of Nutrition and Culinary*, *2*(2), 64–73. https://doi.org/10.21009/jsb.005.1.04
25. Wahyuni, H., & Suranto, S. (2021). Dampak Deforestasi Hutan Skala Besar Terhadap Pemanasan Global di Indonesia. *JIIP: Jurnal Ilmiah Ilmu Pemerintahan*, *6*(1), 148–162. https://doi.org/10.14710/jiip.v6i1.10083
26. Waluyo, D. (2023). *Jalan Menuju Swasembada Daging Sapi*. Indonesia.Go.Id. https://Indonesia.Go.Id/Kategori/Editorial/7317/Jalan-Menuju-Swasembada-Daging-Sapi?Lang=1#:~:Text=%E2%80%9ckonsumsi%20daging%20sapi%20Indonesia%20pada,Ton%20per%20tahun%2C%E2%80%9D%20jelasnya.
27. Yusuf, A., Alijrih, F., Sabri, A. A., Gibran, S. O., Febriansyah, M. N., Andrian, S. H., & Biworo, M. (2024). Pengaruh Waktu Dalam Proses Elektroplating Dengan Pelapisan Kuningan Terhadap Ketebalan dan Ketahanan Baja Karbon. *Jurnal Ilmu Teknik*, *1*(4), 193–199. https://doi.org/10.62017/tektonik
28. Yusuf, A., Purnomo, E., Ladayya, A. B., Biworo, M., & Andrian, H. (2024). Optimalisasi Mesin Pencacah Pupuk Dalam Mewujudkan Efektivitas dan Efisiensi Pengolahan Limbah Organik. In *Community Development Journal* (Vol. 5, Issue 4). https://doi.org/10.31004/cdj.v5i4.31284
29. Zhang, T., Dou, W., Zhang, X., Zhao, Y., Zhang, Y., Jiang, L., & Sui, X. (2021). The Development History and Recent Updates on Soy Protein-Based Meat Alternatives. *Trends In Food Science & Technology*, pp. *109*, 702–710. https://doi.org/https://doi.org/10.1016/j.tifs.2021.01.060